FACULTY OF ENGINEERING AND ARCHITECTURE

NETWORK AND COMPUTER SECURITY

SUMMARY

Lorenzo De Bie

Academic year: 2020-2021

GHENT UNIVERSITY

CONTENTS

1 INTRODUCTION

1.1 Security in the media

- Security <=> User friendly: work of security personel goes unnoticed when everything is good, but they get blamed when things go wrong.
- Users remains a security risk:
  - Due to lack of knowledge: *1 in 10 in a survey think HTML is an STD - Los Angeles Times* [1]
  - Due to incompetence
  - Information can stell be shared non-digitally
- Nobody is safe: *NSA hackt Belgische cyberprof - De Standaard* [2]
- Privacy vs Security: sacrificing privacy so data can be used for security.
  - *AIVD hackt internetfora, 'tegen wet in' - NRC* [3]
  - *Révélations sur le Big Brother français* [4]
- Check yourself using `https://haveibeenpwned.com/`
- Privacy vs Health: tracing apps in times of COVID-19
- Journalists aren't alwasy exactly IT experts →remain a critic, remain sceptic
- Future trends: blockchains
  - mainly used for data integrity through **public ledgers**
  - Used to log activity.
    - Detect malicious operations, hackers, foreign surveillance, database modifications
    - Equally important as access restrictions
- Future trends: cyber warface
  - Nation wide actions to cause damage or disruption. Can include physical impact and/or harm to human persons
  - Interesting targets: traffic lights, electricity systems, water filtration, power plants
  - Stuxnet:
    - Worm that targeted Iranian nuclear facilities, damaging centrifuges and other hardware
    - Most likely an American-Israeli cyberweapon
  - Petya: ransomware or state attack?
    - Focused strongly on Ukraine systems
    - Made very little money
    - Either very bugge, or very damaging by purpose: permanent removal of files, nuclear power plants, ministries, metros and banks offline, possible link with assassination of Maksym Shapoval
  - Future trends: IoT: *Docs shielded Cheney defibrillator from hacks - CNN* [5]

1.2 Example Incidents

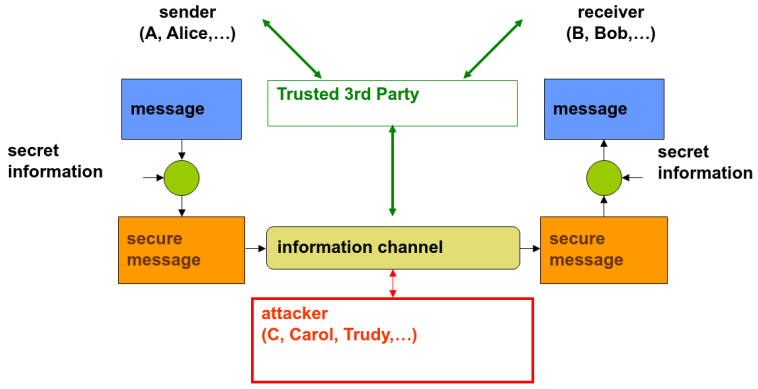
- Ashley Madison (2015)
- DNC email leak (2016)
- Mirai (2016)
- Twitter hack (2020)

1.3 Why do we need security? Why Information Security?

- Counterpart of securing material objects
  - Material object have some **value**
  - Can be stolen or damaged
  - Cost for security/protection takes into account value and risk of theft/damage
- Risk of threats against information security is **much** greater
- Value of information sometimes hard to assess, best estimated by damage caused. Losses cannot be undone
- Threats against information include:
  - **Loss** of information
  - **Forged** information
  - **Unauthorised release** of information
  - **Repudiation** of information
- Value of information systems hard to asses. Systems used to enable service →damage when service unavailable or unreliable
- Threats against information systems include:
  - **Unavailability**/disruption of service
  - **Unauthorised acces** to service
  - Threats against exchanged information
- Security measures for information systems:
  - **Information Security**: encryption, virus scanners, firewalls…
  - Carry some cost (installation, maintenance, computation time)
  - dependent on risk and potential damage

2 BASIC CONCEPTS

2.1 A security model

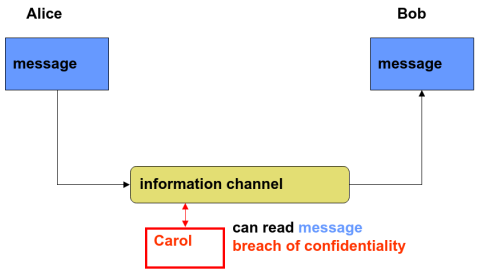


2.2 Security Goals

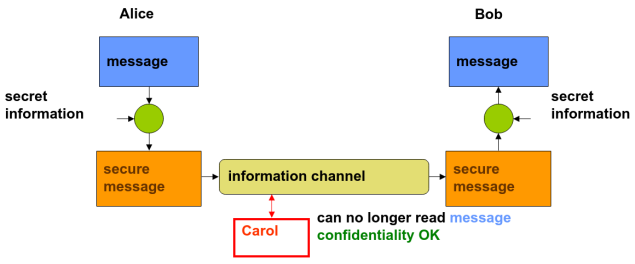
Possible exam question: **Which security goals does this protocol fullfill?**

2.2.1 Confidentiality

- Data can only be read by those who are allowed to read the data
- Applications:
  - Communicating confidential data between branches of a corporation
  - Passwords
  - Storage of health data



(a) Passive attack by Carol: **eavesdropping** upon information channel



(b) Solution to eavesdropping

Traffic-flow confidentiality

- Keeping secret who's communicating with whom
- Much harder to achieve than data confidentiality

- In Figure 2.1b data confidentiality is OK, traffic-flow confidentiality is NOT OK: Carol can still see that Alice is communicating with Bob

Confidentiality vs Privacy

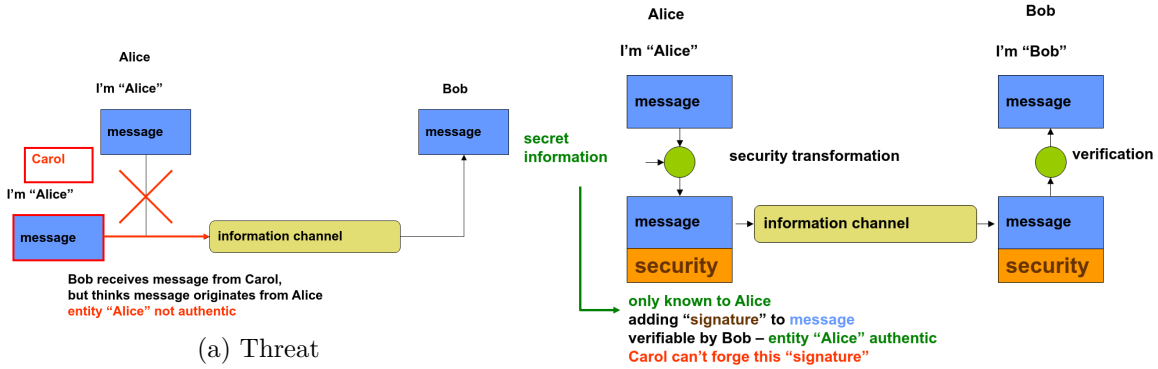
Privacy is having the right to choose what information you give away. It is a fundamental right, legally protected since long. Not every confidentiality requirement involves privacy: intellectual property in a business requires confidentiality, no privacy.

2.2.2 Authentication

Authentication is related to **identification**: it is the *electronic world* equivalent. *Is the person at the other end of the communication who he claims he is?*

Guaranteeing teh authenticity of a communication is based on:

- **Entity** authentication: distinguish each entity from another based on collection of data. Each entity has a unique identity.
- **Attribute** authentication. Attribute = characteristic of an entity. Entities are often authenicated through authentication of some of its attributes. Do the communicating parties exhibit the characteristics they claim to have?
- **Data-origin** authentication: does the data indeed originate from the specified source? Important to evaluate wether data is reliable (**Data Integrity** see 2.2.4). Different from entity authentication: **no interaction with data source**.



(a) Threat

(b) Solution

2.2.3 Access Control/authorization

- Determines which user may access which resource (data, computation time, etc.)
- Requires **authentication of the entity** requesting access to these resources
  - System determines to what extent entity may access those resources
  - Access rights may **depend on entity itself or its attributes**

Illustration 1: access control in OS

- Authentication through login and password
- Access control determined for this user (entity)
  - Full access to own files
  - Limited acces to some other files

  - No acces to other files
- Access rights different from user to user

Illustration 2: access control to medical database

- Different rights for different types of Users
- Requires authentication based on specific **attributes**
- Access rights depend on attributes of the user
- Access rights different from user type to user type (**roles**)

2.2.4 Data integrity

- Guarantee that sent data and received data are identical
  - No tampering with data en route
  - Nothing was added
  - Nothing was deleted
  - Nothing was modified
  - Nothing was replayed
- stronger requirement than data origin authentication: data originates from specified source **AND** isn't changed on the way
- Threats
  - Messages can be replayed
  - Messages can be altered
  - Cannot be solved with confidentiality (encryption): encrypted messages can also be replayed

Solution

A security footer containing a sequence number which can only be generated by the sender. This footer has to be generated based on the whole message to prevent tampering to the message itself. No need to encrypt the whole message for data integrity, but the message is not confidential if it isn't encrypted.

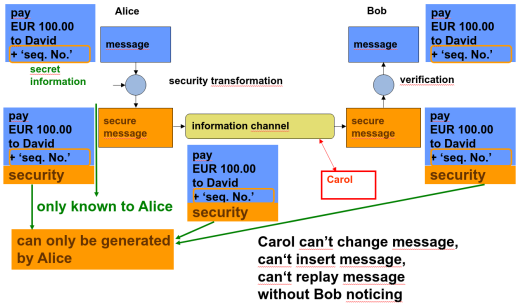


Figure 2.3: Data integrity solution

2.2.5 Non-repudiation

2.2.6 Availability

2.3 Security Threats

BIBLIOGRAPHY

[1] S. Rodriguez, *1 in 10 in a survey think html is an std - los angeles times*, Mar. 2014. [Online]. Available: https://www.latimes.com/business/technology/la-fi-tn-1-10-americans-html-std-study-finds-20140304-story.html.

[2] M. Eeckhaut and V. Nikolas, *Nsa hackt belgische cyberprof - de standaard*, 2014. [Online]. Available: https://www.standaard.be/cnt/dmf20140131_049.

[3] S. Derix, G. Greenwald, and H. Modderkolk, *Aivd hackt internetfora, 'tegen wet in' - nrc*, 2013. [Online]. Available: https://www.nrc.nl/nieuws/2013/11/30/aivd-hackt-internetfora-tegen-wet-in-a1429283.

[4] F. Johannès and J. Follorou, *Révélations sur le big brother français*, Jul. 2013. [Online]. Available: https://www.lemonde.fr/societe/article/2013/07/04/revelations-sur-le-big-brother-francais_3441973_3224.html.

[5] D. Ford, *Docs shielded cheney defibrillator from hacks - cnn*, Oct. 2013. [Online]. Available: https://edition.cnn.com/2013/10/20/us/dick-cheney-gupta-interview/index.html.